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Active Video Gaming as a Strategy for Improving Glycemic Control in People With Diabetes: A Scoping Review

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Abstract
Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin action, or both. Maintaining glycemic control is essential to prevent long-term complications. Physical activity improves glucose uptake and insulin sensitivity; however, adherence to conventional exercise programs remains low among patients with diabetes. Active video gaming (exergaming) has emerged as an innovative digital intervention that promotes interactive physical activity. This scoping review evaluates the effectiveness of active video gaming in improving glycemic control among individuals with diabetes. Literature published between 2013 and 2024 was reviewed using major academic databases. Evidence from randomized controlled trials and clinical studies demonstrates reductions in glycated hemoglobin (HbA1c) and improved glucose regulation following structured exergaming interventions. Active video gaming provides metabolic benefits comparable to moderate-intensity exercise while improving motivation and adherence. The findings support the use of exergaming as a feasible home-based adjunct therapy for glycemic management and tele-rehabilitation in diabetes care.

Keywords: *Diabetes mellitus, glycemic control, HbA1c, blood glucose, exergaming, digital rehabilitation*

1. Introduction
Diabetes is a metabolic disorder which leads to high level of blood glucose. Diabetes mellitus term is originated from Greek word diabetes meaning siphon. Diabetes is one of vast non-communicable disease worldwide. As per International Diabetes Federation every 1 adult among 11 is having diabetes. India, having largest population, has a prevalence 8.9% as of 2019 (77 million). This number is expected to increase and reach up to 100 million by 2030. It has categories such as type 1, type 2, gestational diabetes, neonatal diabetes and maturity onset diabetes. Diabetes mellites pathology is unclear due to multifactorial etiology including intake of high caloric packed food, lack of activities and pollution (3,4). Imbalance in amount of available insulin and glucagon leads to higher level of blood glucose level. Due to excess glucose and less insulin, a physiologically abnormal condition arises known as hyperglycemia. Hyperglycemia Complication of DM involves microvascular, macrovascular, nephropathy, retinopathy, dyslipidemia, hypertension. Diabetic Ketoacidosis is one of the most common acute complications of DM. Management of diabetes includes calory deficit intake, less sugar intake and increase consumption of excess blood glucose Physical activities are one of the most common ways to increase uptake of free blood glucose [1-3]. In the era of technology, incorporating technology in rehabilitation is need of the hour. Virtual Reality is one of such innovative tools. The aim of this scoping review to assess the effect of Virtual reality on blood glycemic level in people with diabetes.

2. Method
This Scoping review was conducted in accordance to guidelines given by PRISMA-ScR. A comprehensive literature search was done using electronic database such as PubMed, Google scholar and Science direct. The search focused on full – text articles published in English from 2013 – 2024. Relevant keywords and Boolean operators ("active video game" OR exergame OR "interactive video game" OR "motion-based game*" OR "virtual reality exercise" OR Wii OR Kinect OR "PlayStation Move") AND("glycemic control" OR "blood glucose" OR "blood sugar" OR HbA1c OR A1C OR "glucose level*" OR "glucose regulation") AND(diabetes OR "diabetes mellitus" OR "type 1 diabetes" OR "type 2 diabetes" OR

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T1DM OR T2DM)were used to identify studies.

2.1. Study Selection:

Only those studies which were published in English, full text, participants who were diagnosed with diabetes type 2 and the VR was used only in active video games were included [4-7]. Studies where participants had gestational diabetes or type1 diabetes, VR used as passive mode to spread awareness were excluded. A single reviewer conducted a literature search across different database. The eligibility of the trials was assessed independently by two reviewers. Any discrepancies that aroused were resolved through discussion. A third reviewer was available for consultation in case of unresolved disagreement.

3. Results and Discussion

3.1. Results

This scoping review identified 7 studies that examined role of active video gaming in controlling glycemic level in individuals with diabetes. Finding of this study suggests active video gaming as feasible, safe and effective method to control the blood glucose level.

3.2. Discussion

The finding of this study is in line with study conducted by Hung et al (2021. Physical activity stimulates glucose uptake in muscles and improves insulin sensitivity over a period of time. Active video games have moderate intensity activities which are sufficient to trigger metabolic response. Kaihara et al (2021) documented high adherence to the exercise as active video games address psychological barriers too. Immediate feedback, rewards and progressive level of difficulties in tasks boosts motivations system. Kempf et al (2013) demonstrated supervised home exercise programmed eliminated barriers like transportation, time etc. and proven to meet the physical targets more effectively [8-10].

Conclusion

Finding of this review supports use of active video game as adjunct therapy to overcome barriers and innovative invention for individuals with diabetes [11-15].

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